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# Web-Based Training: A case study on the development of an Intranet based training course

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# A case study on the development of an Intranet based training course

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## Abstract

Multimedia and hypermedia applications have been successfully used for user training. This paper addresses the question whether the World Wide Web can be used to deliver web-based training of similar quality compared to traditional hypermedia learning systems. The development of a web-based training course for a major company is described, and the lessons learned from that project are discussed.

## Introduction

Web-Based Training (WBT) is a very recent phenomenon, since the World Wide Web (WWW) itself emerged just in the early 90s. Little research has been conducted on the issues involved with the development of a WBT course. However, several areas are related to WBT, where research results exists: distance education, computer based training (CBT), and hypertext/ hyper-media. The following section examines the research conducted in those areas and its relevancy to WBT. First, the implication of the hypertext approach on training systems is examined, followed by a review of computer based testing. Then current research on computer and web based training is reviewed, and the knowledge gaps to be filled by this study are identified.

## Prior Research

WBT is by its very nature a hypertext/hypermedia application, and many of the problems related to hypertext applications design are also present in WBT design. Isakowitz et al. (1995) developed RMM, a methodology for structured hypermedia design. A more specialized design methodology for web based hypertext systems was developed by Biechler and Nusser (1996). These methodologies support the design of hypermedia systems, and provide both visual representations of hypermedia systems, and allow structured training material on a meta-level, that enables the reuse of text and other media in different context, as was proposed by Hardman et al. (1994) in their Amsterdam Hypermedia Model.

For computer based training systems, both computer assisted learning (CAL) and testing have to be supported. Both areas have been studied, but while computerized tests compared favorably to the conventional alternative of paper-based tests (Alavi, 1995; Hecht et al., 1996; Perkins, 1995; Bugbee, 1996; Thoenessen and Harrison, 1996), the research results on the effectiveness of CAL are inconsistent. Alexander (1995) reported good results using CAL vs. control groups, and Ayersman (1996) reported that hypermedia systems are superior to standard hypertext systems in regard to comprehension and recall. Draper (1996) reports problems with user motivation and

difficulties in measuring the effectiveness of CAL systems, and Gibson (1996) reported problems with self-directed learning, if the user interface and the documentation lack sophistication. Eklund (1995) presents studies in which students using hypermedia applications followed linear browsing patterns, and found that only students very familiar with the topic made effective use of true hypermedia systems. Lee (1994) had limited success with a computer based instruction system teaching the BASIC. Despite a thorough design, post-tests showed that the system did not help the users learn the material. Reported possible reasons are the difficulty of the material, unfamiliarity with the subject matter in general, and lack of practice opportunities incorporated in the training system. Based on these findings, one can conclude that hypermedia training systems require a technological literate user, and the system must take the technological level of the training material into consideration.

Studies on implementations of CBT systems and their successes and problems have been conducted by Evans (1995) and Anderson (1996). Evans used Macintosh computers to log student's navigation behavior. Anderson(1996) developed a HyperCard Internet Primer that teaches the usage of email, telnet, and FTP. Interactive exercises were combined with logging instruments. One reported usage of the WWW for training was investigated by Kintze et al. (1996). They developed a web based version of *The Interactive Frog Dissection* and discussed the importance of the WWW as an instructional development and delivery platform. Limited data was collected to demonstrate the usage of their site. Qualitative data was collected using an online open comment form. Nevertheless, the reported interactivity consisted merely of different hypermedia pages and quicktime movies.

Epstain and Madey (1997) developed a framework to build curriculum models on the Internet. They discuss the problems of self-directed learning and the use of Internet technology for training. Asynchronous WBT allows the solitary learner to access the training material on a self paced base. In order to do so, the learner must be familiar with the interface that the system provides. In the case of WBT, this is not only the Web browser, but also the interface of the WBT system. Therefore the learner must become accustomed to the format of the training material, the WBT system's interface, and the Internet technologies that present the material. If real-time Internet technologies like online discussion groups or video/voice conferencing are used, another level of technology is introduced that can improve the learning experience, but also requires more skills to deal with the technology.

Reed et al. (1996) reported two major themes that direct future research: The merging of computer-mediated communications and hypermedia, and the technological development that allows users to access hypermedia programs from the Internet. "While these two aspects of the merger between hypermedia and the Internet are exciting, little research has been conducted and these themes will probably direct much of the computer-based research in the years to come."

Research has shown that CBT programs can effectively be used to train users in a variety of areas. Computer based testing is proven to be a viable medium to test users

knowledge, and hypermedia systems combining animation, graphics, and text are more effective than plain hypertext systems. These studies have shown that the development of a successful CBT systems is possible if attention is paid to design issues like the interface and media used. Little research has been conducted that demonstrates that all these issues can be successfully implemented on a WWW based CBT system. Also, most researchers ignored the fact that economic and organizational constraints and goals might force an organization to pursue a solution to its training needs without human instructors, thus requiring some form of CBT. The question remains as to whether WBT can provide adequate training results at significant lower cost, and whether WBT can provide the same level of education as conventional hypermedia CBT systems.

The following section describes Pagemaster, a WBT systems the authors developed for a large manufacturing firm.

## Pagemaster

*'Pagemaster'* is a WBT system developed for a world-wide manufacturer located in North-East Ohio. It consists of ten modules, each of them teaching the employees one area of web publishing. After an employee has completed all modules, she or he is required to take an online-qualification test in which the employee is tested on the material. After successful completion of the test, the employee is allowed to get access to the corporation's test web site. The requirements for the system were that it had to be computer based, world-wide accessible, low in maintenance, secure, platform independent, and always current. An initial assessment of the situation resulted in the choice of the corporation's Intranet and the WWW technology as the only medium to deliver content under these prerequisites.

Approximately twenty screens are organized into a module, targeted to take less than half an hour to complete in order to accommodate the constraints of learning in the workplace environment. Each module contains a screen on prerequisite knowledge, module objectives, and a module overview. Then, content pages use hypermedia technologies to present the user the different concepts. These content pages can not only be utilized as a guided tour during the training phase, but also as individual reference pages for later web-page development questions. In addition to content pages, Pagemaster provides the user with several multiple-choice and fill-in-the-blank types of questions to re-enforce recall.

The system has exercises that allow the user to write hypertext markup language (HTML) code and then 'view' the browser's interpretation of their code, thus providing them with a real-time web-page editing tool within the tutorial. At the end of each module, a quiz is given to the user as a form of self-test, which is then computer graded, and the results including the correct answers are immediately displayed on the user's browser. At the same time, all the activity of the user, including responses to questions and exercises, are logged on the host. This not only provides the training department with performance data of the users, but also allows the examination of relations between results of exercises, quizzes, and user's performance in them. This technology can also be utilized by

researchers who are interested in the learning behavior of users, e.g., how many times did a user try to find the correct answer in an exercise before the user looked at the solution, or skipped the exercise.

Current research on learning suggests that immediate feedback supports the learning experience (Thoennessen, 1996; Anderson, 1996). Automated grading was therefore a must, not only for the final examination, but for exercises as well. In addition, correct answers are provided if the response was incorrect. A consistent user interface, across platforms and browsers, was chosen in order to allow users to work on different platforms without having to adjust to a different screen layout. It also allowed the authors to ensure a high level of presentation quality. This restricted the choice of colors and HTML codes that could be used to those supported by the corporation's browsers and computer platforms.

Following Reeves (1993) recommendations for formative evaluation and experimentation, two groups of students were used to test the system. The first group (15 MBA students) confirmed the functionality of the CGI scripts and the user interface. Structured questionnaires, time logging, observation, and open interviews with individual users led to further improvements of the interface and the instructions to the system. The second group (180 undergraduate students) demonstrated the functionality of the WBT. Results from exercises as well as from quizzes were logged on an individual bases and statistically evaluated.

The experiments showed that once users were familiar with the interface and the use of Web browsers, they could use Pagemaster successfully. However, users who were not familiar with Web browsers reported difficulties in accessing the training material. We are investigating means to study the effectiveness of Pagemaster. Currently, Pagemaster is being used as a course supplement to teach students in addition to HTML the basics of UNIX, Java, and JavaScript. We plan on conducting further experiments with students to improve the system. Then, experiments with our sponsor's employees will be conducted to see whether our system meets the requirements set by the corporation.

## Expected Benefits and Features from WBT

There are a number of benefits an organization can expect from WBT:

- Elimination of travel time and travel cost
- Low or non-existing distribution cost of training material
- Real-time grading of interactive exercises through CGI scripts
- Immediate feedback to users, training, IS department
- Tracking of individual performance on question and exercise base
- Single point of maintenance on site host
- One copy of material that is always current
- No recall actions of outdated material necessary
- Hypermedia learning systems accommodate various learning styles
- Pages can be used as learning and reference material

- Worldwide distribution
- Platform independence

## Problems with WBT

One has to keep in mind that to achieve its platform independence, the WWW limits its technology. Therefore, WBT has limitations:

- Cross-platform, cross-browser layout consistency is very difficult and timely to fulfill with HTML.
- Bandwidth on the Inter/Intranet is limited, therefore multimedia applications like audio and video can not be used as frequently and with the same quality as with CD-ROM based multimedia systems.
- Access to Internet/Intranet with a graphical browser is required.
- Cheating and security is a problem of distributed CBT systems.
- Direct control over testing may be technically difficult.
- Latency over a network can limit the effectiveness of interactivity.

## Conclusions and Further Research

This study shows that a WBT system can be successfully created, incorporating not only current multimedia technology, but also sophisticated interactivity in the form of real time grading, logging, and tracking user behavior. Currently, modified versions of the Pagemaster are being used as course supplements in the area of HTML, Java-Script, Unix, VB-Script, and CGI programming.

Future research has to investigate how effective these systems are in regard to learning. Repetitions of the studies of Alexander (1995), Draper (1996), and Eklund (1995) using WBT systems are needed to show whether WBT can provide comparable results as stand-alone CBT systems using multimedia. While the current study tested WBT in the classroom learning environment with university students, it is necessary to examine whether a system like Pagemaster can effectively support learning in the workplace.

## References

References available upon request.